BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

5

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : C08L 1/26, A61K 9/48 — A1

(11) International Publication Number: WO 98/27151

(43) International Publication Date: 25 June 1998 (25.06.98)

(21) International Application Number: PCT/US97/22177

(22) International Filing Date: 5 December 1997 (05.12.97)

(30) Priority Data:
96/15580 17 December 1996 (17.12.96) FR

(71) Applicant: WARNER–LAMBERT COMPANY [US/US]; 201 Tabor Road, Morris Plains, NJ 07950 (US).

(72) Inventors: CADE, Dominique; 11, rue des Americains, F–68000 Colmar (FR). HE, Xiongwei; 20, rue Ed. Richard, F–68000 Colmar (FR). SCOTT, Robert, Anthony; Koninin Elisabethplein 26, Bus 4, B–9100 Sint–Niklaas (BE).

(74) Agents: RYAN, M., Andrea; Warner–Lambert Company, 201 Tabor Road, Morris Plains, NJ 07950 (US) et al.

(81) Designated States: AL, AU, BA, BB, BG, BR, CA, CN, CZ, EE, GE, HU, ID, IL, IS, JP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MX, NO, NZ, PL, RO, SG, SI, SK, SL, TR, TT, UA, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: POLYMER FILM COMPOSITIONS FOR CAPSULES

(57) Abstract

The present invention relates to non–animal polymer compositions suitable for film forming, particularly hard and soft capsules, comprising water soluble cellulose ethers, hydrocolloides and sequestering agents.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania
AM	Armenia
AT	Austria
AU	Australia
AZ	Azerbaijan
BA	Bosnia and Herzegovina
BB	Barbados
BE	Belgium
BF	Burkina Faso
BG	Bulgaria
BJ	Benin
BR	Brazil
BY	Belarus
CA	Canada
CF	Central African Republic
CG	Congo
CH	Switzerland
CI	Côte d'Ivoire
CM	Cameroon
CN	China
CU	Cuba
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
GE	Georgia
GH	Ghana
GN	Guinea
GR	Greece
HU	Hungary
IE	Ireland
IL	Israel
IS	Iceland
IT	Italy
JP	Japan
KE	Kenya
KG	Kyrgyzstan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
KZ	Kazakstan
LC	Saint Lucia
LI	Liechtenstein
LK	Sri Lanka
LR	Liberia
LS	Lesotho
LT	Lithuania
LU	Luxembourg
LV	Latvia
MC	Monaco
MD	Republic of Moldova
MG	Madagascar
MK	The former Yugoslav Republic of Macedonia
ML	Mali
MN	Mongolia
MR	Mauritania
MW	Malawi
MX	Mexico
NE	Niger
NL	Netherlands
NO	Norway
NZ	New Zealand
PL	Poland
PT	Portugal
RO	Romania
RU	Russian Federation
SD	Sudan
SE	Sweden
SG	Singapore
SI	Slovenia
SK	Slovakia
SN	Senegal
SZ	Swaziland
TD	Chad
TG	Togo
TJ	Tajikistan
TM	Turkmenistan
TR	Turkey
TT	Trinidad and Tobago
UA	Ukraine
UG	Uganda
US	United States of America
UZ	Uzbekistan
VN	Viet Nam
YU	Yugoslavia
ZW	Zimbabwe

POLYMER FILM COMPOSITIONS FOR CAPSULES

Background of the Invention

1. Field of the Invention

The present invention relates to non-animal polymer compositions suitable for film forming, particularly hard and soft capsules, comprising water soluble cellulose ethers, hydrocolloids and sequestering agents.

2. Description of Related Art

Capsules are widely used in the pharmaceutical industry as well as in the health food supplement market. The main usage thereof is as dosage form for solid, semi-solid, liquid, pellet or herbal preparations. A primary objection of these dosage forms is to have a good disintegration after being administered in order to enable an effective dissolution of the active substances in the appropriate digestive organ. Consequently, this disintegration characteristic has to remain stable over time when finished products are stored prior to use.

The traditional material for forming the capsule shell is gelatin, because it has the correct and quite ideal properties. Nevertheless, gelatin has some disadvantages which make it necessary to have other capsule shell materials available. A major unfavorable aspect is the animal origin of gelatin. Other disadvantages are the inconveniences of relatively high water content (10-17%) and the loss of elasticity with decreasing water content. Furthermore gelatin capsules are sensitive to heat and humidity which affects the usability of the product. In particular, soft gelatin capsules are known to aggregate under hot and humid conditions. Under dry conditions gelatin films may induce static charge build up affecting later processing.

As a gelatin substitute the use of water soluble film forming cellulose derivatives is widely described in the literature. Reports of capsules made from cellulose derivatives refer to poor disintegration in vivo especially when compared with gelatin. To overcome this drawback in EP0714656 it is suggested to use hydroxypropylmethylcellulose (HPMC) with a viscosity of 2.4 to 5.4 centistokes in 2% aqueous solution at 20°C with carrageenan as gelling agent and calcium or potassium ions as co-gelling agent. However the very low viscosity of HPMC resulting from lower molecular weight chains induces higher film brittleness. Furthermore, the use of this composition results in an undesirable loss of transparency of the film. Attempts to improve transparency are disclosed in EP0592130 by exposing HPMC to UV radiation prior to capsule processing.

Summary of the Invention

It has been found that a polymer film composition for capsules wherein the ratios of cellulose ethers, hydrocolloids and sequestering agents are 90 to 99.98% by weight of a cellulose ether or mixture of cellulose ethers with a water content of 2 to 10%, 0.01 to 5% by weight of a hydrocolloid or mixtures of hydrocolloids, and 0.01 to 5% by weight of a sequestering agent or agents do not have the mentioned disadvantages.

Detailed Description of the Preferred Embodiments

Suitable cellulose ethers for the present invention are alkyl- and/or hydroxyalkyl substituted cellulose ether with 1 to 4 carbon atoms in the alkyl chains, preferably methyl cellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, hydroxyethylmethyl cellulose, hydroxyethylethyl cellulose, hydroxypropylmethyl cellulose or the like. Especially preferred is HPMC. The amount of the cellulose ether or mixture of cellulose ethers is preferably 95 to

99.98% by weight. The viscosity of the cellulose ether or blend is 3 to 15 cps in 2% aqueous solution at 20°C, preferred 5 to 10, especially preferred 6 cps.

Suitable hydrocolloids include such items as synthetic gums which are capable of gelling without the addition of alkaline or alkaline earth metal ions. The preferred gum for this purpose is gellan gum. Such gum, particularly including gellan gum, may be combined in mixtures producing synergistic properties which mixtures may also include natural seaweeds, natural seed gums, natural plant exudates, natural fruit extracts, bio-synthetic gums, bio-synthetic processed starch or cellulosic materials. More specifically, the mixture may include alginates, agar gum, guar gum, locust bean gum (carob), carrageenan, tara gum, gum arabic, ghatti gum, Khaya grandifolia gum, tragacanth gum, karaya gum, pectin, arabian (araban), xanthan, gellan, starch, Konjac mannan, galactomannan, funoran, and other exocellular polysaccharides of which are preferred the exocellular polysaccharides, such as xanthan, acetan, gellan, welan, rhamsan, furcelleran, succinoglycan, scleroglycan, schizophyllan, tamarind gum, curdlan, pullulan, dextran. The amount of gum present is preferably 0.01 to 2% by weight and especially preferred 0.1 to 1.0%.

The preferred sequestering agents are ethylenediaminetetraacetic acid, acetic acid, boric acid, citric acid, gluconic acid, lactic acid, phosphoric acid, tartaric acid or salts thereof, methaphosphates, dihydroxyethylglycine, lecithin or beta cyclodextrin and combinations thereof. Especially preferred is ethylenediaminetetraacetic acid or salts thereof or citric acid or salts thereof. The amount is preferably 0.01 to 3%, especially 0.1 to 2% by weight.

The sequestering mechanism can be adjusted by addition of either monovalent or divalent cations, such a Ca^{++}, Mg^{++}, K^{+}, Na^{+}, Li^{+}, NH_4^{+} or the like.

Capsules or films with the inventive polymer composition may be manufactured with conventional machines by the conventional processes like extrusion moulding, injection moulding, casting or dip moulding.

The capsules and films have a non-animal polymer composition, an improved dissolution behavior, an enhanced elasticity and show higher transparency. The enhanced elasticity makes the capsules more useful for inhalation products. Furthermore the capsules are not sensitive to formaldehyde, for e.g. from a contaminated fill and they have a better temperature stability compared to gelatin capsules, because a crosslinking at storage on elevated temperatures does not occur.

The inventive polymer composition may contain additionally acceptable plasticizers in a range from about 0 to 40% based upon the weight of the cellulose ether. Suitable plasticizers are polyethylene glycol, glycerol, sorbitol, sucrose, corn syrup, fructose, dioctyl-sodium sulfosuccinate, triethyl citrate, tributyl citrate, 1,2-propylenglycol, mono-, di- or triacetates of glycerol, natural gums or the like as well as mixtures thereof.

The inventive polymer composition may contain in a further aspect additionally pharmaceutically or food acceptable coloring agents in the range of from about 0 to about 10% based upon the weight of the cellulose ether. The coloring agents may be selected from azo-, quinophthalone-, triphenylmethane-, xanthene- or indigoid dyes, iron oxides or hydroxides, titanium dioxide or natural dyes or mixtures thereof. Examples are patent blue V, acid brilliant green BS, red 2G, azorubine, ponceau 4R, amaranth, D+C red 33, D+C red 22, D+C red 26, D+C red 28, D+C yellow 10-, yellow 2G, FD+C yellow 5, FD+C yellow 6, FD+C red 3, FD+C red 40, FD+C blue 1, FD+C blue 2, FD+C green 3, brilliant black BN, carbon black, iron oxide black, iron oxide red, iron oxide yellow, titanium dioxide, riboflavin, carotenes, anthocyanines, turmeric, cochineal extract, clorophyllin, canthaxanthin, caramel, or betanin.

The shaped polymer composition of the invention or the final product thereof may be coated with a suitable coating agent like cellulose acetate phthalate, polyvinyl acetate phthalate, methacrylic acid polymers, hypromellose phthalate, hydroxypropylmethyl cellulose

Coating

17
21.23

phthalate, hydroxyalkyl methyl cellulose phthalates or mixtures thereof to provide e.g. enteric properties.

The polymer composition of the invention may be used for the production of containers for providing unit dosage forms for example for agrochemicals, seeds, herbs, foodstuffs, dyestuffs, pharmaceuticals, flavoring agents and the like.

The improved elasticity of the inventive polymer composition makes it useful for the encapsulation of caplets in a capsule, especially in a tamper-proof form. The encapsulation of a caplet in a capsule is preferred processed by cold shrinking together capsule parts, which are filled with a caplet, which comprises the steps providing empty capsule parts, filling at least one of said capsule parts with one or more caplets, putting said capsule parts together, and treating the combined capsule parts by cold shrinking.

The inventive polymer composition is also useful for encapsulating and sealing the two capsule halves in a process in which one or more layers of the composition are applied over the seam of the cap and body, or by a liquid fusion process wherein the filled capsules are wetted with a hydroalcoholic solution that penetrates into the space where the cap overlaps the body, and then dried.

The improved properties of the polymer composition are demonstrated by the following composition and comparative examples.

COMPOSITION EXAMPLES:

COMPONENTS	COMPOS 1	COMPOS. 2	COMPOS. 3	COMPOS. 4*
HPMC (1)	99.26%	99.62%	99.46%	98.1%
Gellan	0.54%	0.22%	0.54%	0
Na citrate	0.20%	0	0	0
Citric Acid	0	0.16%	0	0
Carrageenan	0	0	0	1.3%
KCl	0	0	0	0.6%

* According to EP0714656

(1) HPMC equilibrated at 50% RH (equivalent to a water content between 5 to 7%)

Composition 5: Conventional transparent hard gelatin capsule

Composition 6: Conventional opaque hard gelatin capsule

Mechanical impact test:

Capsule body parts are submitted to mechanical impact stress of 80 mJ and the percentage of fractured capsules are checked.

EQUILIBRIUM RH	COMPOS. 1	COMPOS. 2	COMPOS. 5	COMPOS. 6
50%	0	0	0	0
10%	0	0	0	5
2.5%	0	0	10	45

Inhalator piercing test:

Capsules are pierced by inhalator device and the percentage of cracks and/or fracture is recorded.

EQUILIBRIUM RH	COMPOS. 1	COMPOS. 2	COMPOS. 5	COMPOS. 6
50%	0	0	0	0
10%	0	0	95	80
2.5%	0	0	95	75

Capsule transparency test:

Capsule bodies are measured for transmittance at 650 nm

CAPSULE	TRANSPARENCY
Composition 1	74%
Composition 2	75%
Composition 4	60%
Composition 5	81%

Dissolution test:

Acetaminophen dissolved from capsules immersed in deionised water at 37°C (USP XXIII), listed is the percentage of acetaminophen after 45 min.

CAPSULE	% DISSOLVED
Composition 1	90%
Composition 2	90%
Composition 3	63%
Composition 5	91%

Dissolution test after exposure to crosslinking agent:

Capsules were filled with lactose containing 40 ppm of HCHO and stored under room conditions for one month, measured is the percentage of acetaminophen dissolved after 45 min.

CAPSULE	% DISSOLVED
Composition 1	90%
Composition 5	22%

Moisture exchange test:

Capsules were filled with dry carboxymethylcellulose sodium salt (CMC) and stored in closed bottle under room conditions.

CAPSULE	INITIAL WATER CONTENT		FINAL WATER CONTENT	
	Capsule	Fill	Capsule	Fill
Composition 1	6.4%	0%	1.4%	1.1%
Composition 5	14%	0%	4.7%	2.0%

CLAIMS:

1. Non-animal polymer compositions for film forming comprising a cellulose ether or mixtures of cellulose ethers, a hydrocolloid or mixtures of hydrocolloids, wherein said hydrocolloids or mixtures of hydrocolloids comprise gellan gum, either singularly or in mixtures with other polysaccharides and a sequestering agent or mixtures thereof.

2. A polymer composition according to claim 1 wherein the ratio of cellulose ether, hydrocolloid and sequestering agent is

a) 90 to 99.98% by weight of a cellulose ether or mixture of cellulose ethers with a water content of 2 to 10%;

b) 0.01 to 5% by weight of a hydrocolloid or mixtures of hydrocolloids, and

c) 0.01 to 8% by weight of a sequestering agent or mixtures of sequestering agents.

3. A polymer composition according to claims 1 or 2, wherein the cellulose ether or mixture of cellulose ethers is selected from alkyl- and/or hydroxyalkyl substituted cellulose ethers with 1 to 4 carbon atoms in the alkyl chains.

4. A polymer composition according to claim 3, wherein the cellulose ether or mixture of cellulose ethers is selected from methyl cellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, hydroxyethylmethyl cellulose, hydroxyethylethyl cellulose, hydroxypropylmethyl cellulose.

5. A polymer composition according to claim 4, wherein the cellulose ether is hydroxypropylmethyl cellulose.

6. A polymer composition according to claims 1 or 2, wherein the hydrocolloid or mixture of hydrocolloids is selected from polysaccharides.

7. A polymer composition according to claim 6, wherein the hydrocolloid or mixture of hydrocolloids also includes one or more of alginates, agar gum, guar gum, locust bean gum (carob), carrageenan, tara gum, gum arabic, ghatti gum, Khaya grandifolia gum, tragacanth gum, karaya gum, pectin, arabian (araban), xanthan, starch, Konjac mannan, galactomannan, funoran or exocellular polysaccharides such as acetan, welan, rhamsan, furcelleran, succinoglycan, scleroglycan, schizophyllan, tamarind gum, curdlan, pullulan or dextran.

8. A polymer composition according to claim 2, wherein the sequestering agent or mixture of sequestering agents is selected from ethylenediaminetetraacetic acid, acetic acid, boric acid, citric acid, gluconic acid, lactic acid, phosphoric acid, tartaric acid or salts thereof, metaphosphates, sodium hexametaphosphate, dihydroxyethylglycine, lecithin or beta cyclodextrin.

9. A polymer composition according to claim 8, wherein the sequestering agent or mixture of sequestering agents is selected from ethylenadiaminetetraacetic acid or salts thereof or citric acid or salts thereof.

10. A polymer composition according to claim 1 wherein

a) the cellulose ether or mixture of cellulose ethers is contained in an amount of 95 to 99.98% by weight;

b) The polysaccharide or polysaccharide mixture is contained in an amount of 0.01 to 2% by weight, and

c) the sequestering agent is contained in an amount of 0.01 to 3% by weight.

11. A polymer composition according to claim 1 wherein the cellulose ether or mixture of cellulose ethers has a viscosity of 3 to 15 cps measured in a 2% aqueous solution at 20°C.

12. A polymer composition according to claim 11, wherein the cellulose ether or mixture of cellulose ethers has a viscosity of 5 to 10, preferred 6 cps measured in a 2% aqueous solution at 20°C.

13. A polymer composition according to claim 1 containing additionally plasticizers in a range from about 0 to 40% based upon the weight of the cellulose ether.

14. A polymer composition according to claim 13 wherein the plasticizer or mixture of plasticizers is selected from polyethylene glycol, glycerol, sorbitol, sucrose, corn syrup, fructose, dioctyl-sodium sulfosuccinate, triethyl citrate, tributyl citrate, 1,2-propylenglycol, mono-, di- or triacetates of glycerol, or natural gums.

15. A polymer composition according to claim 1 containing additional coloring agents in a range from about 0 to 10% based upon the weight of the cellulose ether.

16. A polymer composition according to claim 15 wherein the coloring agent or mixture of coloring agents is selected from azo-, quinophthalone-, triphenylmethane-, xanthene- or indigoid dyes, iron oxides or hydroxides, titanium dioxide or natural dyes.

17. A polymer composition according to claim 15 wherein the coloring agent or mixture of coloring agents is selected from patent blue V, acid brilliant green BS, red 2G, azorubine, ponceau 4R, amaranth, D+C red 33, D+C red 22, D+C red 26, D+C red 28, D+C yellow 10, yellow 2 G, FD+C yellow 5, FD+C yellow 6, FD+C red 3, FD+C red 40, FD+C blue 1, FD+C blue 2, FD+C green 3, or brilliant black BN.

18. A polymer composition according to claim 15 wherein the coloring agent or mixture of coloring agents is selected from carbon black, iron oxide black, iron oxide red, iron oxide yellow, titanium dioxide, riboflavin, carotenes, anthocyanines, turmeric, cochineal extract, clorophyllin, canthaxanthin, caramel, or betanin.

19. Containers for unit dosage forms for agrochemicals, seeds, herbs, foodstuffs, dyestuffs, pharmaceuticals, or flavoring agents produced from the polymer compositions according to claim 1.

20. A container according to claim 19 which is in the form of a pharmaceutical capsule.

21. A container according to claim 19, wherein the container comprises a coating.

22. The container having a coating according to claim 21, wherein the coating is selected from cellulose acetate phthalate, polyvinyl acetate phthalate, methacrylic acid polymers, hypromellose phthalate, hydroxypropylmethyl cellulose phthalate hydroxyalkyl methyl cellulose phthalates or mixtures thereof.

23. Caplets encapsulated in a polymer composition according to claim 1.

24. Capsules according to claim 20, wherein that the capsule halves are sealed with one or more layers of the polymeric composition according to claim 1.

25. Capsules according to claim 20, wherein that the capsule halves are sealed by a liquid fusion process.

INTERNATIONAL SEARCH REPORT

national Application No
PCT/US 97/22177

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C08L1/26 A61K9/48

According to International Patent Classification(IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61K C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 246 693 A (SHIN-ETSU CHEMICAL CO. LTD.) 25 November 1987 see page 5, line 24 - page 6, line 15 see page 7, line 25 - page 8, line 6 see abstract	1,3-5, 13-16, 18-20,23
A	BE 686 537 A (THE DOW CHEMICAL) 7 March 1967 see page 7, line 20 - line 29 see claims	1,3-5, 13-16, 18-20,23
A	GB 643 853 A (ELI LILLY AND COMPANY) 27 September 1950 see page 4, line 42 - line 48	1,3,4,8, 9,14,19, 20,23

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of theinternational search	Date of mailing of the international search report
3 April 1998	27/04/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Mazet, J-F

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 97/22177

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 012, no. 128 (C-489), 20 April 1988 & JP 62 249935 A (TOYO KAPUSERU KK), 30 October 1987, see abstract ---	1,8
A	EP 0 592 130 A (JAPAN ELANCO COMPANY LIMITED) 13 April 1994 cited in the application ---	
A	EP 0 714 656 A (JAPAN ELANCO COMPANY LIMITED) 5 June 1996 cited in the application -----	

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 97/22177

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 246693 A	25-11-87	JP 1847843 C	07-06-94
		JP 62266060 A	18-11-87
		JP 1845979 C	25-05-94
		JP 63127757 A	31-05-88
		AU 592433 B	11-01-90
		AU 7270287 A	17-12-87
		CA 1286067 A	16-07-91
		DE 3781201 A	24-09-92
		US 4993137 A	19-02-91
		US 5032074 A	16-07-91
BE 686537 A	07-03-67	DE 1617432 A	31-05-72
		FR 1500996 A	24-01-68
		GB 1144225 A	
		NL 6612510 A	08-03-67
		SE 337654 B	16-08-71
		US 3493407 A	03-02-70
GB 643853 A		NONE	
EP 592130 A	13-04-94	JP 6116139 A	26-04-94
EP 714656 A	05-06-96	JP 8208458 A	13-08-96